CLAIMS

We claim:

1. An apparatus for the catalytic cracking of hydrocarbonaceous feedstocks comprising:

(a) a first narrower riser reactor section having a radius x, a means for feeding a hydrocarbon feedstock and a means for feeding cracking catalyst located in a lower portion thereof;

(b) a second wider riser reactor section having a radius y wherein the ratio of y:x ranges from about 1.1:1 to about 5.0:1 operatively connected to said first narrower riser reactor section by a first diameter transition section;

(c) a riser product conduit having an inlet operatively connected to said second wider riser reactor section by a second diameter transition section and having an outlet operatively connected to a means for separating catalyst from cracked product; and

(d) a disengager vessel having an upper dilute phase, and lower dense phase, said upper dilute phase suitable for receiving cracked product gases and for supporting said separator means; and said lower dense phase suitable for receiving catalyst from said separator means; said disengager vessel further comprising an outlet for removing separated cracked gases from said separator means.

2. An apparatus as defined in Claim 1 wherein the ratio of y:x ranges from about 1.25:1 to about 2.5:1

3. An apparatus as defined in Claim 1 wherein said first diameter transition section operatively connects said first narrower reactor section to said second wider reactor section at an angle ranging from about 5° to about 30°.

4. An apparatus as defined in Claim 3 wherein said angle ranges from about 8° to about 20°.

5. An apparatus as defined in Claim 1 wherein said riser product conduit has a radius of approximately x.

6. An apparatus as defined in Claim 5 wherein said second diameter transition section operatively connects said riser product conduit to said second wider reactor section at an angle ranging from about 5° to about 30°.

7. An apparatus as defined in Claim 1 wherein said riser product conduit further comprises a quench injection means.

8. An apparatus as defined in Claim 1 wherein said separator means comprises a cyclone separator.

9. An apparatus as defined in Claim 1 wherein said lower dense phase of said disengager vessel is equipped with a means for stripping hydrocarbons from the catalyst particles.

10. An apparatus as defined in Claim 1 further comprising a regenerator vessel comprising a means for receiving spent catalyst from said dense phase catalyst bed of said disengager vessel, means for regenerating said catalyst, and means for recycling regenerated catalyst to said first narrower reactor section.

11. A process for the fluid catalytic cracking of hydrocarbonaceous feedstocks comprising:

(a) cracking said hydrocarbonaceous feedstock in the presence of a cracking catalyst in a first reaction zone at a temperature ranging from about 925°F to about 1350°F and a weight hourly space velocity greater than about 50 hr^{-1} to produce an intermediate cracked product rich in gasoline;

(b) cracking said intermediate cracked product rich in gasoline in the presence of said catalyst in a second reaction zone at a

temperature ranging from about 900°F to about 1250°F and a weight hourly space velocity ranging of less than about 30 hr^{-1} to produce a cracked product rich in propene and butenes and spent catalyst;

(c) separating said spent catalyst from said cracked product rich in propene and butenes.

12. A process as defined in Claim 11 wherein the temperature in said first cracking reaction ranges from about 1000°F to about 1150°F.

13. A process as defined in Claim 11 wherein said weight hourly space velocity in said first cracking reaction ranges from about 50 to about 200 hr^{-1}.

14. A process as defined in Claim 13 wherein said weight hourly space velocity in said first cracking reaction ranges from about 70 to about 80 hr^{-1}.

15. A process as defined in Claim 11 wherein the conversion in said first cracking reaction ranges from about 35 to about 60 percent.

16. A process as defined in Claim 11 wherein dilution steam in an amount up to about 20 weight percent based on the weight of said hydrocarbonaceous feedstock is added to said first reaction step.

17. A process as defined in Claim 11 wherein the temperature in said second reaction step ranges from about 900°F to about 1250°F.

18. A process as defined in Claim 11 wherein the weight hourly space velocity in said second reaction step ranges from about 5 to about 20 hr^{-1}.

19. A process as defined in Claim 11 wherein dilution steam in an amount up to about 20 weight percent based on the weight of said hydrocarbonaceous feedstock is added to said second reaction step.

20. A process as defined in Claim 11 further comprising quenching the separated cracked product stream.

21. A process as defined in Claim 11 further comprising stripping the separated spent catalyst to removed entrained product vapors, and regenerating said stripped spent catalyst for recycling to said first cracking reaction.

22. A method for converting a fluid catalytic cracking system to an improved deep catalytic cracking system comprising the steps of:

(a) removing a middle section of a riser reaction in the fluid catalytic cracking system to produce a lower first narrower riser reactor section having a radius x, a means for feeding a hydrocarbon feedstock and a means for feeding cracking catalyst located in a lower portion thereof, and an upper riser product conduit having connection to a cracked product/spent catalyst separation means;

(b) replacing said removed middle riser section with a second wider riser reactor section having a radius y wherein the ratio of y:x ranges from about 1.1:1 to about 5.0:1 and operatively connecting the bottom of said second wider riser reaction section to the top of said first narrower riser reactor section by a transition reaction section and operatively connecting the top of said second wider riser section to the bottom of said upper riser product conduit.